



## INDUSTRIAL PRODUCTS DIVISION (ITT)

## MODEL NO. 2135-D

(See Schematics Nos. 23-36A and 23-36B)

TUBE: Type — 21ECP7; Accelerating Poten-

SYSTEM: Magnetic

## AMPLIFIER

Parallel Yoke Switch Position — Main Input: continuously variable from 20 mv to 200 volts p-p/inch.

Auxiliary Input: approximately constant at 12 volts p-p/inch. Series Yoke Switch Position — Main Input: continuously variable from 10 mv to 100 volts p-p/inch. Auxiliary Input: approximately constant at 6 volts p-p/inch.

(< 1.6" deflection centered vertically): Parallel connection of yoke —  $1.5 \pm 0.15$  microsec; Series connection of yoke —  $2.3 \pm 0.25$  microsec.

(&lt; 1.6" deflection centered vertically): Parallel connection of yoke — none. Series connection of yoke —

Frequency Response (Within limits set by maximum deflection characteristics): Parallel connection — down 1 db at 180 kc  $\pm 10\%$ ; down 3 db at 270 kc  $\pm 10\%$ . Series connection of yoke — down 0.1 db at 180 kc  $\pm 10\%$ ; down 1 db at 130 kc  $\pm 10\%$ ; down 3 db at 100 kc  $\pm 10\%$ .

Frequency Response: D-c Input — uniform to d-c. A-c — down 3 db at 1.6 cps.

## AMPLIFIER

Range:  $3.5 \pm 0.35$  microsecond (< 1.17" deflection horizontally).

Less than 10%.

Frequency Response (Within limits set by maximum deflection characteristics): Down 0.1 db at 180 kc  $\pm 10\%$ ; down 1 db at 135 kc  $\pm 10\%$ ; down 3 db at 100 kc  $\pm 10\%$ .

Frequency Response: D-c Input — uniform to d-c. A-c — down 3 db at 1.6 cps.

## TUBE

Continuously variable in 4 decade ranges from 10 sec/inch to 1 sec/inch.

Accuracy:  $+1 -6\%$  on 0.1 to 1 second/inch range;  $\pm 5\%$  on 10 to 100 microsec/inch range;  $\pm 2\%$  on other ranges.

Sensitivity — Approximately -20 volts required to deflect 1 inch. Impedance: 250X shunted by approximately 45 ohms.

SUPPLY: Separate low voltage rack-mounted supply with 4 ft power cable.

REQUIREMENTS: 105 - 125 volts single phase, 50 - 60 cps, 500 watts maximum.

## JACKSON MODEL CRO-2

(See Schematics Nos. 23-37A through 23-37E)

## FREQUENCY RESPONSE

— Amplifier set for wideband operation: Sine-wave response uniform within 10% from 20 cycles to 4.5 megacycles.

— Amplifier set for high sensitivity: Sine-wave response uniform within 10% to 100 kc., down not more than 50% at 200 kc., down not more than 50% at 300 kc.

— Amplifier: Sine-wave response uniform within 10% from 20 cycles to 100 kc., down not more than 50% at 200 kc.

## SIGNAL FACTOR

Amplifier — High sensitivity — 0.018 volts rms

sine for 1-inch peak-to-peak deflection. Wideband — 0.25 volt rms sine for 1-inch peak-to-peak.

Attenuation factors of 10 and 100 available for both high sensitivity and wideband.

Horizontal Amplifier — 0.40 volt rms for 1-inch peak-to-peak deflection. Attenuation factor of 10 available.

HORIZONTAL SWEEP: Frequency range 20 cycles to 50 kilocycles.

POWER SUPPLY SOURCE: Rating — 110-120 volts, 50-60 cycle. Power consumption — 60 watts.

## KNIGHT MODEL 83YZ-144

(See Schematic No. 23-38)

## VERTICAL AMPLIFIER

Sensitivity: 0.025 volt (rms) per inch

Frequency Response: Flat to 2.5 mc within 1 db; to 5 mc within  $\pm 3$  db.

Input Impedance: In 1 attenuator position 2.9 megohms shunted by 21 mmfd. In 0.1 and 0.01 positions 3.4 megohms shunted by 12 mmfd.

## HORIZONTAL AMPLIFIER

Sensitivity: 0.6 volt (rms) per inch

Frequency Response: -3 db at 600 kc; -4 db at 1 mc

## SWEEP GENERATOR

Range: 15 cycles to 600 kc

Synchronization: Internal positive; internal negative; external; line frequency

## KNIGHT MODEL 83YZ-146

(See Schematic No. 23-39)

## VERTICAL AMPLIFIER

Sensitivity: 0.025 volt (rms) per inch

Frequency Response: 3 db down at 700 kc (1000 cps reference)

Input Impedance: 3.3 megohms shunted by 45  $\mu$ fdCalibration: 1 volt p-p  $\pm 7\%$  square wave, regulated, calibrating voltage internally injected by front panel push switch

## HORIZONTAL AMPLIFIER

Sensitivity: 0.07 volt (rms) per inch

Frequency Response: 3 db down at 200 kc (1000 cps reference)

SWEEP GENERATOR: Range — 15 cycles to 150 kc in four ranges

## LABORATORY FOR ELECTRONICS MODEL 411

(See Schematics Nos. 23-40A through 23-40C)

CATHODE-RAY TUBE: Type — 5ABP-1; P7 or P11 optional. Accelerating Potential: 3000 to 4000 volts; adjusted at factory to obtain vertical sensitivity of 15 mv/cm.

## Y-AXIS AMPLIFIER

Deflection Sensitivity: 15 mv/cm peak-to-peak (max) for both dc and ac.

Frequency Response: dc to 10 megacycles (3 db point)

## X-AXIS

Sweep Time Range — Calibrated: 0.1  $\mu$ sec/cm to 0.1 sec/cm; accuracy  $\pm 5\%$ ; linearity  $\pm 5\%$ 

Frequency Response: dc to 1 megacycle (3 db point)

Internal Trigger Sensitivity: 0.5 cm of deflection for signals having slope of greater than 20 cm/sec

External Trigger Sensitivity: 1.0-100 volts for triggers having slope of greater than 40 volts/sec



**Z-AXIS:** Cathode of CRT a-c coupled with 0.05  $\mu$ f into 47 k. A positive 15-volt pulse will blank beam for normal intensity settings

**POWER REQUIREMENTS:** 105–125 volts, or 210–250 volts, 50–60 cycles, 385 watts

### METRIX MODEL 222\*

(See Schematic No. 23-43)

**CATHODE-RAY TUBE:** Type: DG 10-2; diameter:  $3\frac{3}{4}$ " (97 mm); useful diameter:  $3\frac{1}{8}$ " (80 mm); sensitivity: 43 volts peak-to-peak per inch deflection vertical (17 v/cm); 57 volts peak-to-peak per inch deflection horizontal (22.5 v/cm).

#### VERTICAL AMPLIFIER

Frequency response: Flat to 3 db up to 500 kc/s  
Sensitivity: 70 mv per inch deflection (28 mv/cm)

#### HORIZONTAL AMPLIFIER

Frequency response: Flat to 3 db up to 300 kc/s  
Sensitivity: 700 mv per inch deflection (280 mv/cm)

**TIME BASE:** Linear sawtooth — frequency 10 c/s to 50 kc/s; duration 100 ms to 20  $\mu$ s.

**POWER SUPPLY:** Frequency: 50–60 c/s; volts: 110–130 – 220–240; power input: about 60 va.

\* Compagnie Générale de Métrologie, Annecy, France.

### MILLEN MODEL 90915

(See Schematic No. 23-42)

**CATHODE-RAY TUBE:** Accelerating voltage — 2100 volts, permits use of P1, P7, or P11 screens.

#### FREQUENCY RESPONSE

Vertical Amplifier or Horizontal Amplifier

D-c amplifier using either the terminals or the probe and at any gain setting: 0 to 100 kc +0 –10%; 0 to 200 kc +0 –30%; 0 to 400 kc +0 –50%. Square-wave response 0 to 10 kc

A-c amplifier using either the terminals or the probe and at any gain setting. Same as d-c amplifier except low frequency 3 db point is 0.3 cycle. Square-wave response 30 cycles to 10 kc

#### SENSITIVITY

Vertical Amplifier

Terminals: D-c — 0.3 volt dc per inch deflection. A-c — 0.3 volt peak-to-peak per inch deflection; 0.106 volt rms per inch deflection.

Probe: D-c — 3.0 volts dc per inch deflection. A-c — 3.0 volts peak-to-peak per inch deflection; 1.06 volts rms per inch deflection.

Horizontal Amplifier: D-c — 0.375 volt dc per inch deflection. A-c — 0.375 volt peak-to-peak per inch deflection; 0.133 volt rms per inch deflection.

**SWEEP RANGE:** 2 cycles per second to 30 kc per second with provisions for adding external capacity for slower sweeps

**POWER REQUIREMENTS:** 105 to 125 volts 50/60 cycles, or 210 to 250 volts 50/60 cycles; 105 watts power consumption

### MILLEN MODEL 90923

(See Schematic No. 23-41)

**CATHODE-RAY TUBE:** Accelerating Voltage: 2040 volts, permits use of P1, P2, P7, or P11 screens

#### FREQUENCY RESPONSE

Vertical Amplifier: 7 cycles to 125 kc  $\pm$  2 db  
Horizontal Amplifier: 2 cycles to 125 kc  $\pm$  2 db

#### SENSITIVITY

Vertical Amplifier: 0.88 volt peak-to-peak per inch — 0.31 volt rms per inch deflection; 0.12 volt rms per inch deflection.

Horizontal Amplifier: 1.02 volts peak-to-peak per inch deflection; 0.36 volt rms per inch deflection; 0.14 volt rms per cm deflection.

**SWEEP:** Range: 2 cycles per second to 30 kc per second

**POWER REQUIREMENTS:** 105 to 125 volts 50/60 cycles  
Size: 1 ampere

### PACO MODEL S-50

(See Schematic No. 23-44)

#### PUSH-PULL VERTICAL AMPLIFIER

Sinusoidal Frequency Range: 5 cycles to 1.2 mc, within 6 db to 2 mc.

Sensitivity: 90 millivolts rms per inch at 1000 cps

#### PUSH-PULL HORIZONTAL AMPLIFIER

Sinusoidal Frequency Response: Flat within  $\pm$  3 db, 6 db or better at 700 kc

Sensitivity: 250 millivolts rms per inch at 1000 cps

### PACO MODEL S-55

(See Schematic No. 23-45)

#### VERTICAL CHANNEL (3-Stage, Push-Pull)

Sensitivity: Dc — 70 millivolts/inch. Ac — 0.3 volt rms/inch.

Frequency Response (Sine Wave): Dc — within 3 db to 4.5 mc; within 5 db at 5 mc. Ac — within 3 db from 1 cps to 4.5 mc; within 5 db at 5 mc.

Rise Time: 0.08 microsecond or better.

Overshoot: 5% or less.

#### HORIZONTAL CHANNEL (Push-Pull Output)

Sensitivity: 0.6 volt rms/inch.

Frequency Response: Within 3 db, 1 cps to 4.5 mc

Frequency Range: 10 cps to 100 kc sawtooth, 100 cps to 100 kc sine wave. Provision for external capacitor from 1 cps.

### PRECISE MODEL 300-B

(See Schematic No. 23-46)

**CATHODE-RAY TUBE:** Type: 7JP1/7AP1 — 7VP1 tube used in original equipment, although 7JP1 may be substituted.

**VERTICAL:** Sensitivity — 10 millivolts per inch (0.4 mv/cm), push-pull inputs. Bandwidth — 100 kc, 5 megacycles (3 db).

**HORIZONTAL:** Sensitivity — 150 millivolts per inch (6 mv/cm) single-ended input.

**SWEEP RATE (NORMAL):** Multisync — 5 Position Coarse-Frequency Sweep — 10–100 cycles (external capacitor circuit); 100–1000 cycles (internal); 1 k–10 k (internal).

### PRECISE MODEL 300

(See Schematic No. 23-47)

**TUBE:** Type: 8CP1 — P1 phosphor, medium power screen normally supplied, other types available.

**VERTICAL:** Sensitivity — 10 millivolts per inch (0.4 mv/cm)



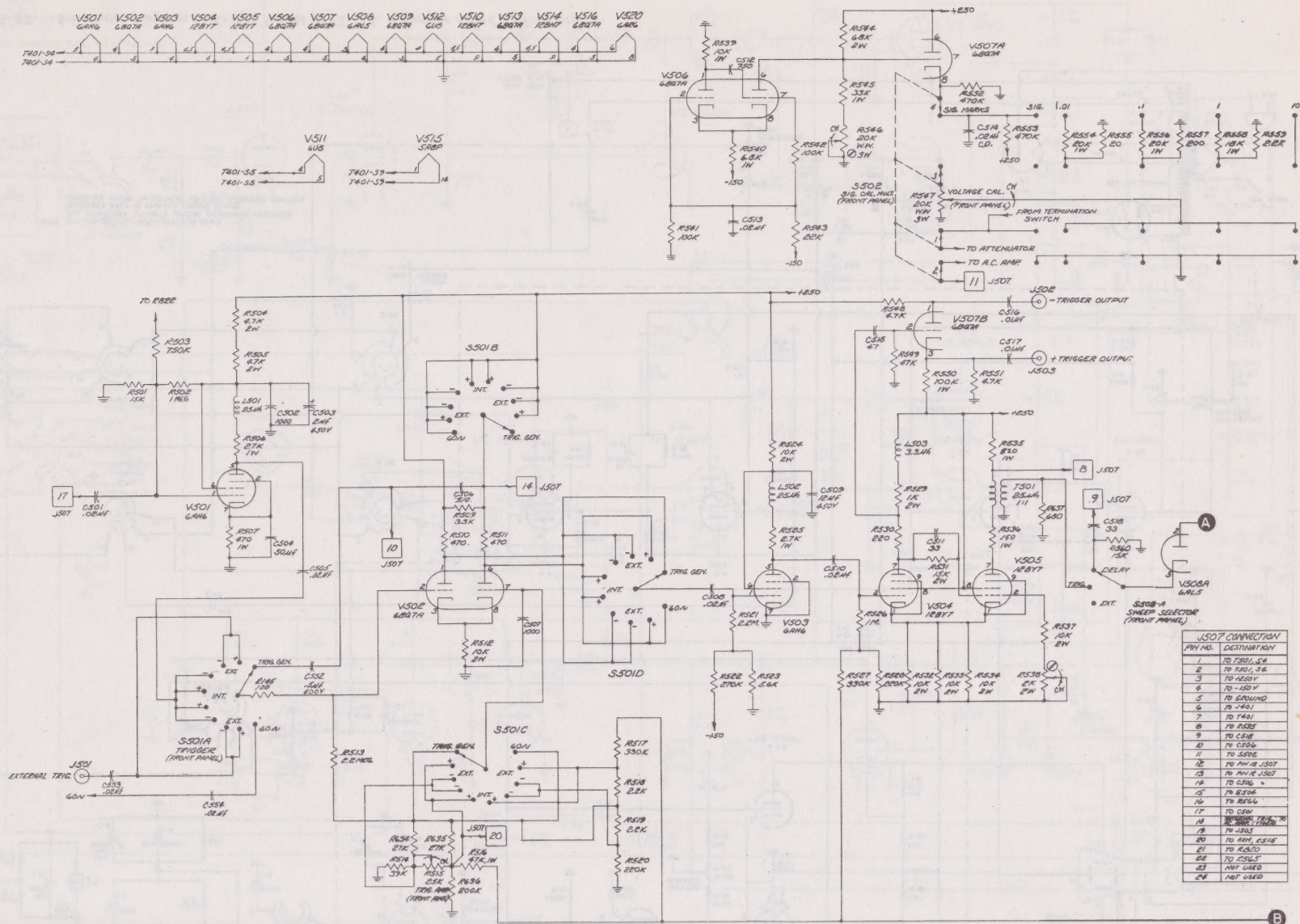
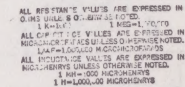


Fig. 33-40A. Signal chassis of LIE Model 411. Courtesy Laboratory for Electronics, Inc.





**Fig. 23-40A.** Signal chassis of LfE Model 411. Courtesy Laboratory for Electronics, Inc.





